

Serial No. 09/544,822

IN THE SPECIFICATION:

Please replace paragraph 10 on page 5 of the specification with the following text:

C1  
[0010] The present invention relates to a method and apparatus for underfilling the gap between a bumped or raised semiconductor device and a substrate. The present invention is directed to a method and apparatus for filling the gap between a semiconductor die and a substrate using underfill material where the semiconductor die is electrically and mechanically connected to the substrate. The method and apparatus includes the use of a wetting agent on at least a portion of the surface of the semiconductor die forming a portion of the gap between the semiconductor die and a substrate to which it is mounted and/or a wetting agent on at least a portion of the substrate forming a portion of the gap to increase the surface tension between the underfill material and the surface of the semiconductor die and/or the substrate. One embodiment of the present invention includes a layer of silane as a wetting agent on at least a portion of the active surface of the semiconductor die and/or a layer of silane on at least a portion of the upper surface of the substrate to which the semiconductor die is mounted, each layer of silane increasing the surface tension thereon, the increased surface tension allowing the underfill material to fill the gap between the semiconductor die and the substrate via capillary action forces in a lesser length of time. Various wetting agents may be used according to the present invention, such as glycidoxypyltrimethoxysilane and ethyltrimethoxysilane.

Please replace paragraph 33 on pages 9 and 10 of the specification with the following text:

C2  
[0033] In the present invention, prior to connecting the semiconductor die 12 to the circuits and/or contact pads on the upper surface 18 of the substrate 10, a wetting agent layer 2, such as a silane layer 2, is formed on the top surface 18 of substrate 10 and/or the active surface 20 of the semiconductor die 12. The wetting agent layer 2, such as a silane layer 2, can be formed thereon by any suitable spray method, brush application method, and/or a dispense

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C2  
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method, although spraying a silane layer 2 as a wetting agent layer is the preferable method in order to provide a substantial uniform layer thereon. The silane layer 2 is most preferably formed as a monolayer thickness but may be formed as one or more multiple layers or formed in addition to other layers promoting a wetting effect on the surface of either the upper surface 18 of the substrate 10, the active surface 20 of the semiconductor die 12, or both. The silane layer 2 may be provided to the surface of the semiconductor die 12 while in its wafer form prior to or after burn-in testing, or after the wafer has been diced into multiple individual dice or an individual die. As to the substrate 10, the silane layer 2 may be provided thereon at any stage prior to the semiconductor die 12 being mounted thereto. In addition, the silane layer 2 may be comprised of any silane-based material, i.e., glycidoxypyrroltrimethoxysilane (b.p. 290°C) and Ethyltrimethoxysilane (b.p. 310°C), so long as any substantial degradation thereof during any solder reflow process or curing process of the bumps 24 or any substantial degradation thereof during any burn-in and/or testing process is minimal so that the silane layer 2 promotes a sufficient wetting effect on the active surface 20 of the semiconductor die 12, the upper surface 18 of the substrate 10, or both.